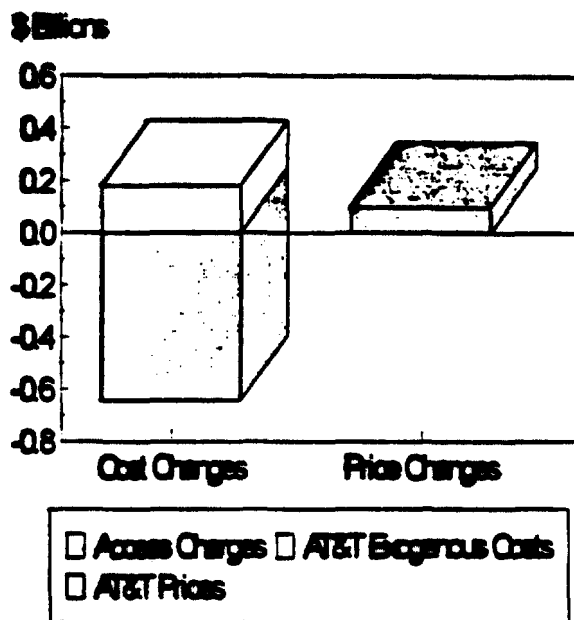## a. Price and Cost Changes

Figure 1
AT&T Cost and Price Changes
1991 - 1995

Source: AT&T Price Cap Filings

Under price caps, the calculation of AT&T's actual price index (API) for each basket supplies all of the necessary information to calculate annual revenue and cost changes associated with toll access price changes.[22] Since the advent of price cap regulation for the LECs in 1991, AT&T has raised prices by $98 million per year, while annual access charge reductions amounted to $0.644 billion and exogenous cost increases that pertain to the industry were $0.181 billion.[23] In other words, the
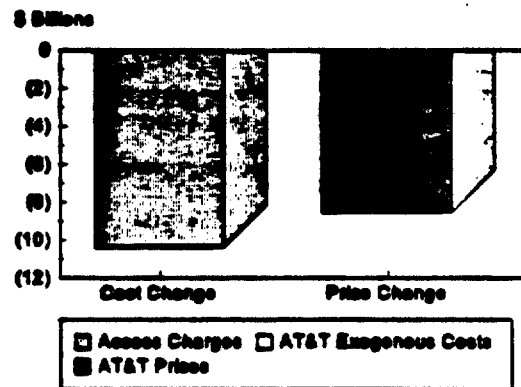
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[22] This simple measure of the pass-through of access charges has two advantages: (1) it is reasonably simple to calculate; and (2) it is familiar to utility analysts, who routinely express price changes in terms of the annual revenue changes they engender.

[23] Only exogenous cost changes that apply equally to all firms in the industry could be passed through in long-distance price changes in a competitive long-distance market.

difference between AT&T's prices and access costs and industry-specific exogenous costs increased by about $561 million (annually). (See Figure 1).

Since divestiture, AT&T has reduced its prices by $8.521 billion, while its annual access charge expenditures fell by $10.299 billion and industry exogenous annual costs fell by $103 million (See Figure 2). Over the entire period, AT&T's price reductions were less than its access charge and exogenous

Figure 2
AT&T Cost and Price Changes
1984 - 1995

cost reductions by $1.881 billion. Prior to price cap regulation, the FCC staff and AT&T performed a similar analysis to measure AT&T's historical real rate of price growth (net of access charge and exogenous cost changes). Our measurements for the pre-1989 period generally agree with those of the FCC Staff and AT&T.[24] See Attachment A.

**b. A Formal Laspeyres Price Index**

As part of its price cap filings, AT&T estimates the dollar amount by which its switched access expenses will be reduced for price-capped services measured using a base level

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[24] Policy and Rules Concerning Rates for Dominant Carriers, Report and Order and Second Further Notice of Proposed Rulemaking, CC Docket No. 87-313, 4 FCC Rcd 2994, 2996 and 3335, 3341 (1989).

of demand (from the previous year).[25] This information can be used to construct conventional aggregate access price and output price indices. We have, in fact, constructed indices of output and carrier access prices for AT&T starting from a base of 100 in 1984. The resulting indices for the post-price cap period (1989 and after) are chain-linked Laspeyres price indices for AT&T-purchased access services and AT&T output for products under price caps.[26] The price indices are (1) Laspeyres because they use base period quantities weights; and (2)

Figure 3
AT&T Toll and Access Price Indices
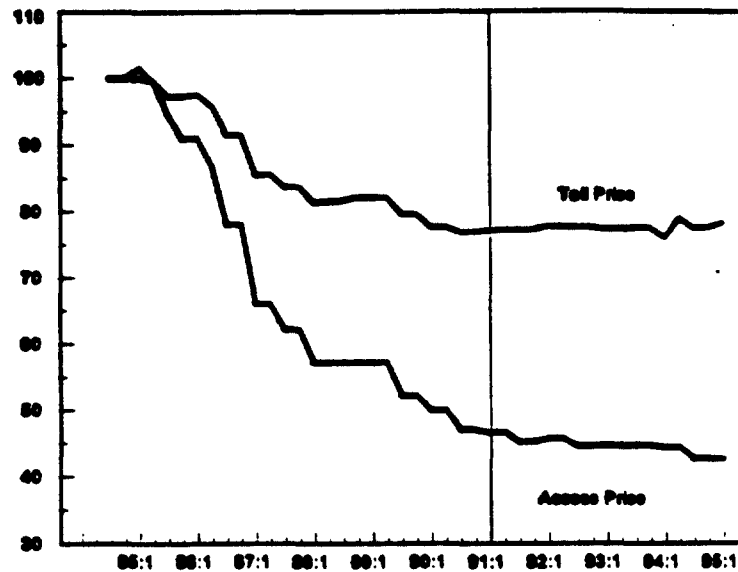
chain-linked because the bases are changed each year to reflect substitution in the mix of outputs. During the pre-price cap period, weights cannot be calculated from publicly-available data. Hence, we began in 1989 with weights from the price cap filing, and adjusted the weights in each previous year to construct a chain-linked Paasche price index for the pre-price cap period.

The computed toll price and access charge indices, which are displayed in Figure 3, indicate that nominal toll prices and access charges declined at annual rates of 2.5 and 8.0

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[25] These indices are specific to AT&T's mix of services and network structure, and they include the effect of new service offerings on demand. See, e.g., attachment to letter from M.F. Del Casino, AT&T Administrator - Rates and Tariffs to W.F. Canton, Acting Secretary, FCC dated May 17, 1994, p. 3, or 47 CFR 61.44(g), 61.46(b), 61.47(b).

[26] See, e.g., Deaton, A. and J. Muellbauer, Economics and Consumer Behavior, (Cambridge: Cambridge University, 1980), p. 170.

percent, respectively, between 1984 (3rd quarter) and 1994 (4th quarter), and at annual rates of +0.1 and -2.3 percent, respectively, during the 1991-1995 price cap period. Net of access charges, toll prices increased by 1.1 and 0.7 percent annually during the post-divestiture and LEC price cap eras, respectively. These results indicate that the combination of competition in the interstate long-distance markets and price cap regulation of AT&T has not produced vigorous price competition, particularly in the residential long-distance market. Net of AT&T's claimed access charge changes and market exogenous cost changes, interstate prices have risen during the LEC price cap period. Thus, the benefits of lower prices and expanded demand for interstate switched services that are sometimes ascribed to competition should be properly attributed to the regulatory policies that have lowered access charges: in particular, subscriber line charges, separations reform, and—during the AT&T price cap period—the implementation of price cap regulation for LEC access services.[27]

2. Average Revenue per Minute, Net of Access Charges

Alternative methods have been proposed to measure the effects of access charge changes on consumer long-distance prices.[28] Instead of calculating indices of prices, these methods use average revenue per minute (ARPM) and average access cost per minute (AAPM) as surrogates for long-distance prices and carrier access charges. The rate of growth of the

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[27] The slower rate of reduction of carrier access charges under LEC price cap regulation is due to the facts that subscriber line charges and major separations rules were essentially unchanged under price caps but had reduced carrier access charges significantly from 1984 through 1988.

[28] See, e.g., R. Hall, "Long-distance: Public Benefits from Increased Competition," Applied Economics Partners, Menlo Park, California, October 1993; M. Seivers, "Should the InterLATA Restrictions be Lifted? Analysis of the Significant Issues," presented at Rutgers University Advanced Workshop in Regulation and Public Utility Economics, 7th Annual Western Conference, July 6-8, 1994; or D.L. Kaserman, Reply Testimony on behalf of AT&T Communications of Pennsylvania, Inc., Docket No. I-00940034, February 23, 1995, p. 6.

difference between these two measures is then taken as an indicator of the degree of price competition in the market.

Two observations from the theory of index numbers are critical to the understanding of how these alternative measures compare to the price indices that we discussed above. First, despite a long history of attempts to measure the effect of price changes on consumer welfare,[29] there remain three unresolved index number issues, concerning the treatment of (1) new products; (2) quality changes; and (3) changes over time in consumers' tastes for specific products.[30] Any application of index number theory (including price or cost indices and changes in ARPM) will be subject to one or more of these shortcomings.

Second, changes in ARPM do not constitute a price index in the traditional sense. As Deaton and Muellbauer explain:

> In the context of consumers, economic index numbers attempt to construct a single ratio that measures one of two things. The first, the cost-of-living index, measures the relative costs of reaching a given standard of living under two different situations, while the second, the real consumption index, compares two different standards of living in some appropriate units.[31]

A change in ARPM neither measures the relative costs of reaching a certain standard of living nor compares two standards of living. ARPM mixes both issues together, using different patterns of consumption and/or different prices in each period.

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[29] See, e.g., Diewert, W.E., "The Early History of Price Index Research," *NBER Working Paper 2713*, September 1988.

[30] See, e.g., Fixler, "The Consumer Price Index: underlying concepts and caveats," *Monthly Labor Review*, December 1993, pp. 3-12.

[31] See, e.g., Deaton and Muellbauer, op. cit., p. 169.

As an example of the kind of errors that can arise from interpreting ARPM as a price index, suppose AT&T customers demand ten minutes of message toll service (MTS) for each minute of wide area toll service (WATS) (and no other products) and that the price of MTS (per minute) is twice that of WATS. If MTS and WATS prices increase slightly but demand for WATS grows at 50 percent per year while MTS demand grows at 10 percent per year, then the ARPM of usage declines by slightly less than two percent. In other words, ARPM declines despite the fact that both of the component usage prices have increased.[32]

A similar problem arises in the context of volume discount plans. Suppose the prices in the plan remain fixed, but customers are able to receive lower effective marginal prices when their demand expands (e.g., because they have installed fax machines). In that case, ARPM would decline not because the price of usage declined, but because customer demand increased.

For a third example, suppose the price of the initial period of a call is higher than the price of additional periods. As long-distance prices have fallen since divestiture, demand for calls has grown, as has the holding time (the average duration of a call). ARPM has thus fallen because holding time has increased. Clearly this effect does not make consumers better off and does not reflect competitive pressure on IXC prices.

ARPM will also overstate the effect of a price change if the own-price elasticities for different services are different, even when the percentage price change for each of the

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[32] This effect is not merely a theoretical possibility. According to AT&T's 1994 Annual Report, "Although we raised prices on basic services over the past two years, the shift in the mix of services that customers selected reduced average per-minute revenues in 1994 and 1993" (at 24). In contrast, Professor Hall claims that ARPM for AT&T is not affected substantially by changes in the mix of services demanded (at 7, footnote 3). There is no documentation supporting this assertion, and it seems obvious that these kinds of differential service growth rates occur frequently in telecommunications. He suggests later that MCI and Sprint have been "particularly successful" in selling services which bypass LEC access facilities (at 24). If they have been "particularly successful" because customers' tastes for these kinds of services have shifted, then ARPM overstates the effect of any price change.

services is identical. For example, suppose (1) the price of service A is one dollar per minute, ten minutes are sold, and the A own-price elasticity is -0.2, and (2) service B has a price of fifty cents per minute, a demand of ten minutes and an own-price elasticity of -5.0. If each of the service prices decreases by 10 percent, ARPM will decrease by 17 percent. In this case, a change in ARPM overestimates the extent of the price change by almost a factor of two. Note that the problem does not arise through substitution—the demands for the products are independent in this example—but rather because of the inadequacies of the index itself.

The same criticisms of ARPM would affect an AAPM statistic. If consumers' tastes for bypass services (for example, because of improved reputations and recognition of alternative access providers) change over time, then AAPM will be similarly biased as a measure of access price change. We would, however, expect AAPM to be less susceptible to the infirmities described above since access charges are not differentiated by customer type.

Despite these and other concerns and qualifications,[33] we have examined two publicly available sources of ARPM data for AT&T. First, in an *ex parte* filing in CC Docket No. 94-1, AT&T reported ARPMs and AAPMs for 1984 and 1994. Although no supporting data is available (and it is not stated to what services these calculations apply), simple arithmetic shows that AT&T claims ARPM net of access charges fell by only 2 cents per minute over the post-divestiture decade. The associated annual rate of change is -1.5 percent, and since inflation

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[33] Calculating ARPM net of access charges for AT&T or for IXCs as a whole is a difficult procedure if one relies upon data confined to the public record. Oddly, in this regulated industry, there is no available measure of AT&T or industry-wide switched conversation minutes of use (interstate, intrastate or total) or interstate revenues from switched services. Switched carrier access minutes are available for AT&T and the industry, but the growth of bypass (or services such as Megacom) makes interstate carrier access minutes a poor measure of the demand for interstate switched services. As a result, the components of ARPM (even in the aggregate) and access expenditures per conversation minute are unknown, and debates concerning their magnitude are not likely to be useful.

averaged 3.5 percent during the period (as measured by the GDP-PI), AT&T is asserting that ARPM net of access charges fell at a real rate of about 5 percent per year. This real rate of "price" reduction net of access charges compares with an average real reduction in access charges over the 1972-1983 period of about 6.3 percent per year.[34] Despite rapid growth in demand, massive advertising, implementation of equal access, introduction of lower-cost digital switches and optical fiber transport, adoption of price cap regulation and erosion of AT&T's market share, AT&T's calculated ARPM net of access charges fell more slowly in real terms than during the decade prior to divestiture.

Second, some insight into the source of the reported reductions in ARPM can be obtained from an examination of AT&T's price cap filings. Basket 1 ARPM net of access charges can be calculated based on revenue and access expense reported in each of AT&T's price cap filings.[35] These results, which are shown in Figure 4, indicate that on average, ARPM

Figure 4
ARPM Net of Access Charges Increased for Basket 1

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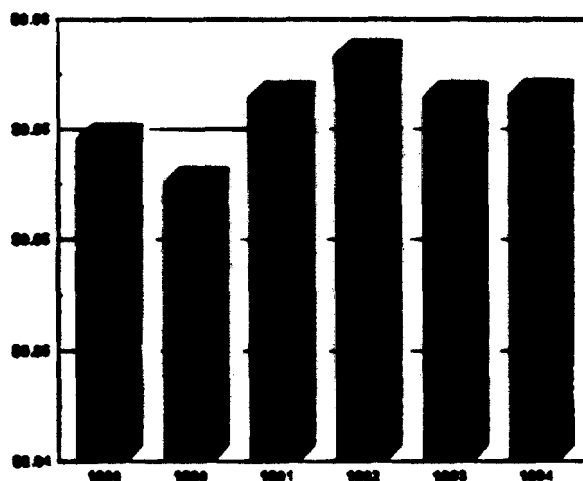
[34] According to the BLS producer price index for interstate toll, real interstate MTS rates fell at an annual rate of 2.6 percent from 1972 to 1983. During this period, the FCC increased interstate revenue requirements by 3.7 percent per year to shift additional non-traffic sensitive costs onto interstate toll services. Thus, net of these separations changes, real interstate MTS rates fell at an annual rate of about 6.3 percent between 1972 and 1983. If forgone stimulation is accounted for, real MTS rates declined at about 8 percent per year during this period.

[35] Specifically, we calculated this measure as the average Basket 1 revenue per switched access minute less the average Basket 1 access expense per switched access minute.

less AAPM rose about 0.7 percent per year over the 1989-1994 period. This calculation is consistent with AT&T's stated pricing objectives:

> Although we raised prices on basic services over the past two years, the shift in the mix of services that customers selected reduced average per-minute revenues in 1994 and 1993.[36]

Thus, AT&T's claimed reduction in ARPM net of access charges is achieved by charging higher prices to low-volume users. Indeed, any customer who consumed the same bundle of services in 1994 as he or she consumed in 1984 failed to receive lower prices in the amount of access charge reductions. While AT&T's reported ARPM has declined, competition has not brought benefits of lower prices to low-volume users. Moreover, low-volume users appear to be the vast majority of residential customers. According to a random sample of 9000 household telephone bills taken in mid-1994, less than one-third of U.S. households use IXC discount calling plans and less than one-third of IXC residential calls are billed at discounted rates.[37]

3. Comparison of the Indices

Despite the concerns noted in the previous section, we can make some limited comparisons between the various indices described above, with the help of some additional data. First, our previous studies used an AT&T estimate of the annual price effect of customer

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[36] AT&T Annual Report, 1994, at 24.

[37] PNR and Associates, Bill Harvesting Study, 1995, at 2-3. A similar number is reported by G. Naik, "Costs of Control: Long-distance rates, after falling for many years, have started heading higher," *Wall Street Journal*, March 20, 1995.

<table>
<tr><th>Year</th><th>Professor Hall</th><th>AT&T Price Index</th><th>NERA Laspeyres AT&T Index</th><th>Adjusted Interstate Toll CPI</th></tr>
<tr><td>1985</td><td>100.0</td><td>100.0</td><td>100.0</td><td>100.0</td></tr>
<tr><td>1989</td><td>59.2</td><td>75.2</td><td>78.2</td><td>76.0</td></tr>
</table>

**Table 1
Nominal Toll Prices
1985 and 1989**

migration to high-volume services to adjust our estimated price changes towards the concept measured by ARPM.[38] Even if we adjust our estimates downward to account for migration to lower-priced services, we still find that AT&T price decreases remain less than the decreases in AT&T's access charge expenses.[39] Second, as part of the LECs' annual access charge filings, AT&T developed and placed on the public record an extensive, detailed series of interstate MTS price indices that it used to forecast test period demands for interstate switched access minutes of use.[40] We have compared the percentage decline in nominal toll prices obtained from four sources: (1) Professor Hall's study;[41] (2) the AT&T interstate price index;[42] (3) our Laspeyres price index; and (4) the BLS CPI interstate toll price

[38] In its price cap review filing, AT&T used the fact that during the 1989-1991 period, prices actually paid by AT&T customers fell at an annual rate of 0.9 percent due to migration to lower-priced services such as SDN. See R. Schmalensee and J. Rohlfs, "Productivity Gains Resulting from Interstate Price Caps for AT&T," report filed by AT&T in CC Docket No. 92-134, September 3, 1992, Table II. If we assume conservatively that migration occurred at this rate throughout the period, our estimate of the annual growth of AT&T's prices overstates the annual growth in ARPM by about 0.9 percentage points.

[39] See Taylor and Taylor op. cit. p. 187.

[40] These price index data are available through 1989, at which point the advent of price cap regulation rendered such demand forecasts unnecessary. The price indices vary across states because of differences in traffic mix, length of haul and time of day distributions. See AT&T, In the Matter of 1990 Annual Access Charge Filings, Before the Federal Communications Commission, April 27, 1990, Appendix B, Figure 10, various states.

[41] Hall, op. cit. Data Appendix, Figure 4, first column.

[42] AT&T, In the Matter of 1990 Annual Access Charge Filings, Before the Federal Communications Commission, (continued...)

index, adjusted by 0.9 percentage points per year to account for migration to high-volume services (see Table 1).[43] All series are normalized to 100 in 1985 to simplify the comparison. The table shows that Professor Hall's 1989 prices are substantially lower than the other series.

The pattern of price changes in these indices is also revealing. Table 2 shows correlation coefficients between AT&T's API from Basket 1 of its price cap filings,[44] Professor Hall's price index, the Laspeyres price index ("L. Index") we computed above, AT&T's price index from their access demand proceedings, and the CPI for interstate toll services. The correlations between the annual growth rates in the indices are shown in Table 3. Even the correlations in the growth rates suggest that the price index AT&T selected for its modeling efforts is highly correlated with the BLS price index and the Laspeyres price index that we computed. On the other hand, the correlation coefficient for Professor Hall's ARPM-based price index measured with respect to AT&T's own filed price index is 0.7, which is quite low.

Table 2
Correlation Matrix
Price Levels

	API	Hall	L. Index	AT&T	CPI
API					
Hall	0.976				
L. Index	0.995	0.983			
AT&T		0.982	0.996		
CPI	0.962	0.974	0.997	0.997	

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[42] (...continued)
April 27, 1990, Appendix B, Figure 10, California prices.

[43] Schmalensee and Rohlfs, op. cit., Table II.

[44] Adjusted, or not, for migration to high-capacity services. The adjustment would not affect the correlations.

4. Conclusions

Regulated competition

in the interstate toll market has
not yet led to the price reductions
that would be expected from
vigorous price competition. While
prices for some services have
been reduced substantially, the

price reductions have been caused,

	API	Hall	L. Index	AT&T	CPI
API					
Hall	0.993				
L. Index	0.986	0.788			
AT&T		0.705	0.989		
CPI	0.768	0.816	0.957	0.996	

Table 3
Correlation Matrix
Growth Rates

in large measure, by changes in carrier access prices. On a per-minute basis, access charges have fallen by about 50 percent since 1984, while long-distance prices have fallen substantially less. The divergence in price and cost reductions has allowed AT&T's per-minute margins to increase on a volume of minutes that is greater than it was in 1984, even though its share of total switched interstate minutes has dropped by about 25 percent over the same period. Evidence from the relationship among price, cost, and AT&T's firm-specific price elasticity of demand suggests pricing behavior inconsistent with a price-taking firm in a competitive market.

B. Pricing Behavior

In competitive markets firms have no power over price and cannot exploit market power (this is a definition of market power). As a matter of logic, if we observe indications of market power or power over price, then the market is not competitive or not fully disciplined by competitive forces. In the section below we test the hypothesis of whether competition (or

some other force) limits pricing behavior by testing for evidence of market power. If we find evidence of market power then we must reject the hypothesis that competition limits pricing behavior in favor of an alternative hypothesis.

1. Theory

Professor Bresnahan proposes a method to estimate the degree of monopoly power in a market based upon observed evidence of individual firms' pricing behavior.[45] Bresnahan's method relies upon one of the fundamental relationships of economic theory, according to which each firm sets the price of a good to maximize profits subject to the constraints determined by its costs and by the price elasticities[46] implicit in its *firm-specific perceived demand curve*.[47]

This relationship is expressed formally as follows:

$$P_i = \frac{c_i}{1 + \frac{\theta}{\epsilon_i}}$$

[45] Bresnahan, T.F., "Empirical Studies of Industries with Market Power" in The Handbook of Industrial Organization, edited by Richard Schmalensee and Robert D. Willig, North-Holland, 1989, pp. 1032-1033.

[46] The elasticity of perceived demand effectively incorporates a large proportion of the basic information required to estimate pass through because it directly takes both demand structure and competitor response into account. For example, the less elastic (i.e., price sensitive) a firm's demand curve is, the less customers switch to other products or brands as the firm's price increases. Supply constraints on competitors would also show up in a low perceived demand elasticity. On the other hand, a firm will presumably believe its demand curve is relatively inelastic if the nature of (imperfect) competition in the industry is such that others will match its price increases.

[47] The relevant demand curves are: (1) *firm specific* because customer price responsiveness, degrees of substitutability, capacity constraints and competitor responses may vary across firms in an industry; and (2) *perceived* because each firm must set price in advance according to is its expectations of the relationship between its price and the quantity it will sell, allowing for all possible influences, including the substitution of alternative products by customers and potential competitor reaction.

where:

> p_t is the price of a good at time t;
>
> c_t is the cost of a good at time t; and
>
> ϵ_t is the price elasticity of demand for a good at time t.

This relationship can be rewritten as:

$$\ln(p_t) = \ln(c_t) + \ln(1 + \frac{\theta}{\epsilon_t})$$

In this context, when $\theta=0$, AT&T acts as a perfect competitor, since changes in marginal cost are passed through to price completely. If $\theta=1$, AT&T acts as a monopolistic competitor following the classic model used by Chamberlain.[48] If $\theta>1$, AT&T acts as a cartel member, in the sense that the demand curve that AT&T faces is less elastic than it otherwise would be because the other IXCs set their prices as though the prices were controlled by AT&T.

2. Estimation

We applied Bresnahan's method using an independent estimate of AT&T's own price elasticity obtained from the staff of the Federal Trade Commission (FTC) in addition to price and cost indices for AT&T calculated based upon publicly available data.[49] We estimated a

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[48] Chamberlain, E.H., The Theory of Monopolistic Competition, (Massachusetts: Harvard University Press, 1933).

[49] Reply Comments of the Staff of the Bureau of Economics of the Federal Trade Commission, In the Matter of Revisions to Price Cap Rules for AT&T, CC Docket No. 93-197, October 25, 1993. We must rely upon the staff's estimate because (1) we lack the proprietary data from AT&T and the other IXCs that is necessary to develop our own independent estimates; and (2) although we cannot specifically endorse the elasticity analysis in the staff's report since we are not in the position to replicate it or test its sensitivity to various

(continued...)

version of the equation above using two-stage least squares with variables that shift the demand curve (population, real disposable income, time trends, the CPI) as instruments.[50] Our analysis yielded the following equation estimate (the t-statistics are shown in parentheses below each of the coefficient estimates):

$$ lnP_t = -2.31 + 0.41\,lnA_t + 0.0072\,time - ln(1 + \frac{2.55}{\epsilon_t}) $$
$$ \quad\quad (-5.1) \quad (5.0) \quad\quad\quad (3.4) \quad\quad\quad\quad\quad\quad (18.8) $$

where:

- lnP_t is the natural logarithm of price, as measured by our Laspeyres price index for AT&T (described previously);

- lnA_t is the natural logarithm of access price, as measured by our Laspeyres access price index for AT&T (using the same methodology as the price index);

- $time$ is a time trend measuring other components of cost that trend smoothly over time; and

- ϵ_t is the price elasticity of demand for a good at time t calculated using Ward's results.

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[49] (...continued)
assumptions, the results have been made public and were subjected to the criticisms of economists in academic seminars (e.g., an early version of the staff's analysis was presented by Michael Ward at the Rutgers Sixth Annual Eastern Conference of the Advanced Workshop in Regulation and Public Utility Economics, May 6, 1994).

[50] The instrumental variables method is required because the elasticities are estimates and therefore are subject to measurement errors which are a function of price.

The constant term measures the effect on price of components of cost that remained constant over time, while the time trend measures the effect on price of changes in nonaccess costs over time. The coefficient of log cost measures the cost share of access, as well as the percentage change in price that arises from a percentage change in access charges.[51]

Our estimate of θ (2.55) far exceeds the level that one would expect under competitive market conditions. In fact, the evidence suggests that if regulation and the threat of antitrust intervention is *not* a limiting factor, then AT&T has set its prices in the mode of a cartel member facing an inelastic demand curve. Moreover, our estimates of θ do not appear to be sensitive to changes in the price and cost

Table 4
Coefficients and t-statistics using various price and cost variables
(t-statistics in parentheses)

Price Variable	Cost Variable	Theta	Cost Share
Hall	Hall	2.731 (130.3)	-0.296 (-2.8)
CPI	AT&T Access	2.361 (10.2)	0.585 (8.3)
AT&T Index	AT&T Access	2.552 (18.8)	0.409 (5.0)

indices used in our analysis. As Table 4 shows, the estimates of θ remain far in excess of competitive levels regardless of whether we employ price and cost indices based on Professor Hall's data or whether we replace our own AT&T price index with the CPI for interstate toll calling.

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[51] There is also a cost effect that arises because the elasticity changes as price changes. Because the impact is small, we have disregarded this effect in our estimation efforts.

3.   Conclusions

Using settled economic theory, AT&T's own data filed in price cap proceedings and estimations from the FTC staff, our results reject the hypothesis that AT&T acts as a competitive firm in the interstate long-distance market. Thus, if its prices are not constrained by regulation or the threat of antitrust intervention, then AT&T would wield substantial market power because of coordinated pricing behavior among the IXCs.

There is anecdotal corroboration of coordinated price changes among the IXCs. For example, in 1993, AT&T increased its basic prices, permitted by a regulatory change in accounting costs for post-retirement benefits (SFAS 106). Then

> (f)ollowing hard on AT&T's heels, MCI Telecommunications Corp. and Sprint Communications Co., L.P. have proposed across-the-board increases in their interstate rates for business and residential services. Exactly one week after AT&T filed tariff revisions with the FCC raising its business service rates by an average of 3.9% and its residential rates by about 1% overall, Sprint and MCI both filed tariffs on July 23 introducing similar rate increases. A veteran Washington observer said last week that the rate increases 'don't say much for the level and intensity of competition in the interstate services market.'[52]

Since the change in costs pertained only to regulated firms—unregulated firms' prices already reflected accrual accounting for post-retirement benefits—there is no cost justification for an industry-wide increase in price.

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[52] "MCI, Sprint Match AT&T's Across-the-Board Rate Increase," *Telecommunications Reports*, August 2, 1993, p. 34.

C. Productivity

Competition provides powerful incentives for firm to reduce costs and develop products that consumers value. In addition, rate of return regulation has been criticized for providing only limited incentives for innovations in production process (cost reduction) and product innovations, so that the adoption of price cap regulation for AT&T should—all else equal—also stimulate increases in the rate of productivity growth. We will look for an increase in the rate of productivity growth between the pre- and post-divestiture periods. If this is the case—or if productivity growth has at least not fallen since divestiture—the fact that AT&T's claimed real rate of growth of ARPM net of access charges is significantly slower than in the pre-divestiture period cannot be due to decreased productivity growth. Indeed, if productivity growth is high during the post-divestiture period, then the mere pass-through of carrier access charge reductions in IXC prices is insufficient in the sense that a competitive market would lower prices even further.

The evidence regarding post-divestiture productivity growth is mixed, and there are no productivity growth measures for AT&T on the public record. Indirect measurement of total factor productivity (TFP) growth using the real rate of growth of industry prices indicates no trend in productivity growth over long periods of time. Using data constructed by Spavins-Lande,[53] we compare real rates of output price growth for the telecommunications industry averaged over successive ten year periods. The results show no long-term trend in productivity growth and no more rapid productivity growth in the post-divestiture decade. Direct measures

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[53] Policy and Rules Concerning Rates for Dominant Carriers, Supplemental Notice of Proposed Rulemaking, CC Docket No. 87-313, (released March 12, 1990), Appendix D, "Total Telephone Productivity in Pre and Post Divestiture Periods," by T.C. Spavins and J.M. Lande.

of productivity growth show similar trends, albeit for parts of the telecommunications industry

other than AT&T. Productivity growth for LECs averaged 2.6 percent per year in the post-

divestiture decade which is close to the Bell System TFP growth estimates of the decade before

divestiture. An ambitious productivity study by R.W. Crandall and J. Galst of The Brookings

Institution measured TFP growth between 1961 and 1988 for the telecommunications sector, the

(reconstituted) Bell System, independent LECs, and the new IXCs.[54] The authors conclude that

> estimates of TFP grow much more rapidly between 1971 and 1983 than
> between 1961 and 1970, the period of no competition in interexchange
> services. Estimated declines in total factor productivity 1984-85, the year
> of divestiture, could simply reflect measurement problems or transitory
> inefficiencies...After fairly modest increases between 1984 and 1985, total
> factor productivity accelerated between 1986 and 1988. Thus, TFP now
> seems to be growing more rapidly than in the 1970s. In fact, TFP
> growth has accelerated over the entire postliberalization period of 1971-
> 1988.[55]

In our view, TFP growth is too volatile from one year to the next to permit a reliable inference

that productivity growth has increased in the post-divestiture period. Nonetheless, there is

certainly no evidence that telecommunications productivity growth has slowed in the 1985-1995

period. Thus a reduction in TFP growth does not explain the fact that real interstate toll prices

net of access charges fell more rapidly in the 1972-1983 period than in the post-divestiture

period.

Moreover, the weak evidence on productivity growth suggests that the pressures from

competition to reduce costs that AT&T has faced since divestiture are not measurably greater

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[54] R.W. Crandall and J. Galst, "Productivity Growth in the U.S. Telecommunications Sector: The Impact of the AT&T Divestiture," The Brookings Institution, February 28, 1991. Some of these results appear in R.W. Crandall, After the Breakup: U.S. Telecommunications in a More Competitive Era, Washington, D.C.: The Brookings Institution, 1991.

[55] R.W. Crandall, op. cit., p. 69.

than the regulatory pressure to reduce costs in the pre-divestiture period. Of course, the mere fact that productivity growth has not accelerated since divestiture does not in itself demonstrate that competition has been ineffective: it could be that technological progress has been slower in more recent years and that in the absence of competition, productivity growth would have increased less rapidly. All the evidence, however, suggests the opposite.

In 1984, AT&T's long-distance network was based almost exclusively on copper wire; its competitors' networks combined copper wireline facilities with microwave radio. Today, long-distance services are supplied through three nationwide optical fiber networks. Fiber technology is characterized by tremendous economies of scale, lower marginal costs than microwave or copper, and a high rate of technological change which doubles the usable capacity of the technology every few years. Demand for switched services has more than doubled since 1984, and most of the costs of an optical fiber network are fixed with respect to volume. Despite these additions to productivity growth, our limited evidence does not show a clear acceleration in measured TFP growth for the industry.

D. Quality

In addition to prices, IXCs compete on quality. AT&T, MCI and Sprint have made the quality of their networks a major selling point in their advertising campaigns. The FCC has

determined that the availability of
facilities-based competition will
"provide the impetus for AT&T to
maintain its existing service quality
levels...."[56] However, in areas without
facilities-based competition (i.e., areas
without equal access), there is a
possibility that AT&T might not
provide the same level of service
quality. Figure 5 shows AT&T's

Figure 5
AT&T Service Quality, Six-month periods
1989-1994
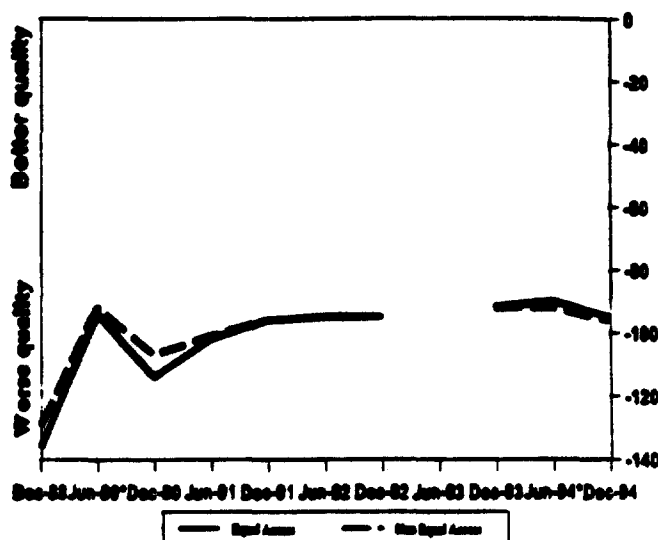
service quality, in both equal access and non-equal access areas, as measured by an index of
equipment-related blockage and failures on outgoing trunks.[57] This figure shows that AT&T's
overall service quality has increased with time for both equal access and non-equal access areas.
The areas with less competition, until the end of 1991, had fewer blocked calls (and hence
higher quality) than the equal access areas. Currently, however, the quality in equal access
areas is slightly better than the quality in non-equal access areas. Obviously, facilities-based
competition is not the driving force behind improvements in quality.

[56] Policy and Rules Concerning Rates for Dominant Carriers, Report and Order, CC Docket No. 87-313, 4 FCC Rcd 287, ¶156 (1989).

[57] AT&T reports the index in its "Outgoing Trunk Service Evaluation," which is published every six months. The report contains two indices, one for AT&T's network alone and one including the switching facilities of the originating carrier. Separate numbers are reported for equal access and non-equal access outgoing trunks. The series used in Figure 5 are the indices calculated with the revised base for AT&T's network alone (the FCC was not able to provide data for June 1993).

E. Advertising

Advertising can serve two economic functions. First, advertising informs consumers about the existence of products and their prices. Thus, in competitive markets with homogeneous products, advertising increases consumer welfare by minimizing search and other transactions costs. For example, a service station advertising its prices on a sign, helps consumers chose between two stations on opposite street corners. In this manner and in these circumstances, advertising can lead to pressures for competitors to reduce prices.

The second economic function that advertising serves is much less beneficial to consumers. Advertising can be used to differentiate products excessively. Economic theory shows that in highly concentrated industries—when price could be adjusted after advertising is sunk—it is optimal for firms to attempt to differentiate their products from one another. In such circumstances, economic theorists conclude "price competition is more limited."[58] Price competition by MCI and Sprint can be retaliated against quickly, once it is detected—advertising cannot be quickly retaliated against.[59] It is noteworthy that AT&T has increased its advertising budget substantially since it has gained pricing flexibility (particularly in the downward direction).

As a general matter, it is very difficult to determine whether or not advertising has had pro-consumer or anti-consumer effects. However, there is some evidence in the interstate

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[58] Ireland, Norman J., Product Differentiation and Non-Price Competition, (New York: Basil Blackwell, 1987), p. 134.

[59] Scherer, op. cit., p. 388.

long-distance market. High rates of churn (about 19 percent per year[60]) indicate that advertising is not informing consumers. If advertising messages made consumers aware of the existence and specific attributes of alternatives and consumers simply selected their preferred alternative from this larger set, then consumer choices should not change frequently over time unless the set of alternatives is constantly changing. Given the apparent variation in consumer choice over time, it is likely that long-distance telephone advertising is of the second type discussed above, on balance to the detriment of consumers.

As a separate effect, economic theorists have recognized that advertising may raise entry barriers and thereby cause harm to competition.[61]

> Image differentiation reinforced through intensive advertising can also be an important barrier to entry, permitting the sustained realization of monopoly profits.[62]

Only firms with large service areas would find it economically feasible to advertise on national television. If potential competitors must compete on Madison Avenue or offer substantial price discounts in the alternative, then only relatively large firms will prevail, particularly when AT&T and the other large facilities-based IXCs determine the margin on which resellers exist.

F. Reseller Entry

Analysis of the conditions of entry—size of entry barriers, size of assets that become sunk after entry, efficient scale of operations—is a cornerstone in the modern economic analysis

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[60] Porter, Michael E. "Competition in Long Distance Telecommunications Markets," p. 7.

[61] See, e.g., Porter, M.E., "Intra brand Choice, Media Mix and Market Performance," *American Economic Review*, May 1976, p. 401.

[62] Scherer, op. cit., p. 404.

of industrial organization. The benefits arising from mobility of capital and freedom of entrepreneurs to attempt to exploit short-run profit opportunities that they believe to exist is a principal component of the economic theorist's case for competition. Actual, observed entry is prima facie evidence that entrepreneurs believe that the particular market has presented an opportunity for them that is at least as good as any other alternative endeavor. In other words, persistent observed entry is evidence of above-normal economic returns.

Some parties point to the number of IXCs operating in the market as evidence of low barriers and ultimate competitiveness of the market. However, this latter inference is unwarranted. The number of firms that can be supported in a market is a function of many economic factors, but chief among them is the structure of costs of production. When fixed costs are low, many firms can be supported in a competitive market. It is also true that under these conditions, a single incumbent producer (but many potential producers) is also consistent with a competitive market. *Ceteris paribus*, evidence of persistent entry is a good signal of above-normal economic returns in a market, and is surely a better signal than the absolute number of firms in the market.

Determining the actual number of firms entering into the interexchange market is difficult. However, Carrier Identification Codes (CICs) are assigned to each company that wishes to purchase equal access services from LECs in order to offer 1+ service in the long-distance market. The number of new codes issued can be used as a rough guide as to the number of firms entering into the market.[63] Figure 6 shows an index of entry and exit,

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[63] CICs are not an exact count of the number of firms in the market: some firms obtain CICs for internal use rather than for use as a common carrier. In addition, at some points in time, companies have been allowed more than one CIC. On April 1, 1993, CICs were divided into two groups (one for Feature Group B and

(continued...)

calculated as the net change in CICs over the total number of CIC "movements" (A CIC may either be assigned or withdrawn).[64] If every CIC "movement" is an assignment (i.e., entry), then the ratio will be 1; if every "movement" is a withdrawal (i.e., exit), the ratio will be -1. For example, if 4 CICs were assigned and 2 were

Figure 6
Net Entry and Exit in IX Markets
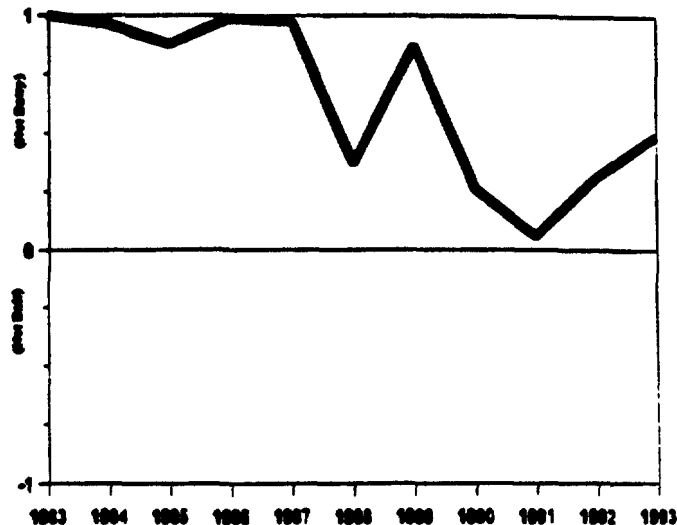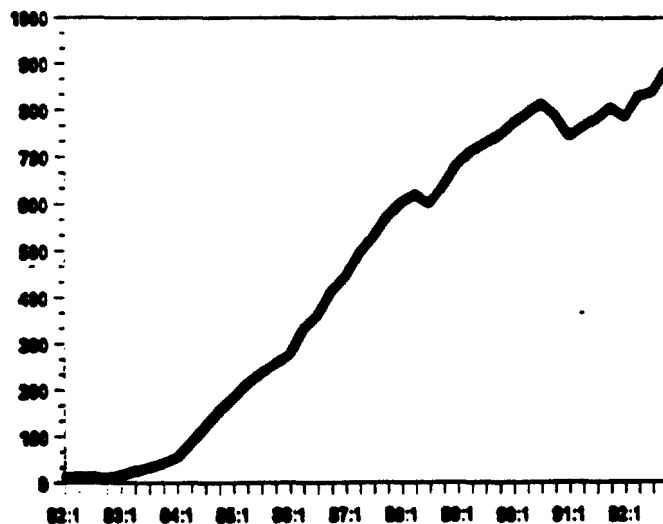**Annual Averages, 1983-1993**

Figure 7
Total CICs Assigned by Bellcore, 1982-1992

withdrawn, the net change in CICs is 2, and the index will be 0.3333. If an equal number of CICs are assigned and withdrawn, then the index is 0, showing no net entry. Figure 7 displays the total number of CICs assigned in each quarter.

Based on these results, we conclude that opportunities for profit

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[63] (...continued)
one for Feature Group D), so current information on CICs is not comparable to pre-1993 data.

[64] The number of CICs withdrawn is not necessarily a good measure of exit. In the fourth quarter 1990 and first quarter 1991, when Bellcore began to run out of CICs, each code was reviewed to make sure the company still existed. In addition, firms which had been assigned multiple CICs, were limited to only one. The high withdrawal rate during this period, then, is due to a reclamation of the CIC database.